Synthetic Biology for Recycling Human Waste into Nutraceuticals, and Materials: Closing the Loop for Long-Term Space Travel

Completed Technology Project (2015 - 2022)

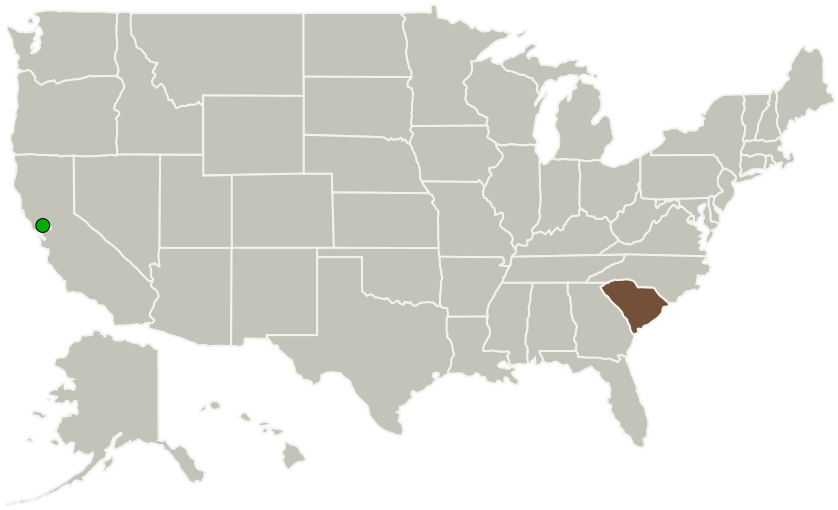
Project Introduction

It is impractical for astronauts to travel with all necessary supplies in future long-term space exploration missions. Therefore, it is imperative that technologies enabling the production of food, nutraceuticals, medicine, and materials from extraterrestrial resources are developed. These resources found in space include minerals and feedstocks found on distant bodies, waste generated by humans and space shuttle operation, and solar energy. Together with synthetic biology-driven technology for engineering microorganisms that can reliably, efficiently, and flexibly utilize such "in situ resources", astronauts may be able to generate the food, nutraceuticals, medicine, and materials they need to carry out their mission. Due to potential uncertainty in resource availability, this proposal focuses on engineering yeast to convert respiration CO2 algae biomass and human urine into nutritional omega-3 fats and 3D printable plastics.

Anticipated Benefits

Astronauts will be able to generate the food, nutraceuticals, medicine, and materials they need to carry out their mission.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Clemson University	Lead Organization	Academia	Clemson, South Carolina
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
South Carolina

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Clemson University

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

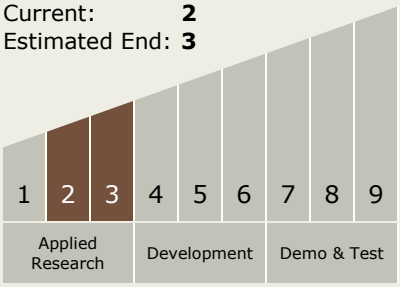
Hung D Nguyen

Principal Investigator:

Mark Blenner

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - TX07.2.1 Logistics Management

Target Destinations

Earth, The Moon